

## **Supporting information for Waiver of 316b studies per 40 CFR 121.22 (r)**

### **Summary**

Multiple surveys, current literature, USFWS designations, as well as a recent consensus on a misidentified mussel specimen from the Elk River indicate that there are no threatened or endangered aquatic mussel species on AAFB or in the headwaters within 10 river miles of the AEDC cooling water intake of Woods Reservoir. In addition, the Area of Influence of the cooling water intake structure is minimal in relation to the size of Woods Reservoir, to the degree that any potential for adverse effects on fish species utilized as hosts by mussel glochidia, would be insignificant. Detailed supporting information follows.

### **Area of Influence (AOI)**

The Cooling Water Intake rule makes reference to "area of influence" (AOI), but EPA provided no definition of this term in the rule or its preamble. However, The Electric Power Research Institute (EPRI) published a report on the subject entitled, "Cooling Water Intake Structure Area-of-Influence Evaluations for Ohio River Ecological Research Program Facilities" (2007). This report states: "The EPA 316(b) Phase II Rule requires that permit applicants provide information on their cooling water intake structure (CWIS) area of influence (AOI). While a formal definition for an AOI does not exist, it is generally considered to be that part of the source water body directly affected by the withdrawal of water by the CWIS or where the natural water velocity vectors are measurably deflected toward the CWIS."

Since AEDC's Primary Pumping Station (PPS) is located in the Brumalow embayment of Woods Reservoir, the average lake water velocity can be calculated using a shoreline to shoreline distance of 1,300 feet at an average depth of 30 feet. Even if we use an extremely high estimate of 10 MGD for Brumalow Creek, the average velocity is only 0.0004 ft/sec. So, we can safely neglect any velocity effects from Brumalow Creek in this analysis.

To simplify the problem, an assumption was made that the water is pulled equally in all available directions, centered on a vertical line at each of the two adjacent intakes at the PPS. For any imaginary vertical half-cylinder (centered at the intake), the velocity at the outer cylinder surface will be equal and pointing toward the intake. A half-cylinder geometry is used since half of the vertical cylinder would be in the water, and the other half would be on the PPS structure itself, and not in the water.

The EPRI report used velocity contours of 0.1, 0.5, and 1.0 ft/sec to define the limits of the AOI. The 0.5 ft/sec corresponds to the EPA's maximum velocity if a screen is used to meet BTA requirements; therefore, using 0.1 ft/sec velocity should be a conservative assumption.

The primary pumping station is configured with two separate intakes with a total of 6 individual pumps. Four of the pumps withdraw water from one intake, and the remaining two pumps withdraw water from the other intake. The maximum flow rates through the two intakes are

93,000 gpm (207.2 cubic ft/sec) and 57,000 gpm (127.0 cubic ft/sec) if only one intake is used at a time. Due to pressure effects related to pump curves, the maximum flow if all pumps six pumps are operating is 104,500 gpm. The depth of the water at the PPS intake is approximately 32 feet. Since we are interested in the distance at which the velocity equals 0.1 ft/sec, we need to find the radius of the half-cylinder that has a maximum face velocity of 0.1 ft/sec. The radius of a half-cylinder is equal to the volumetric flow/(pi x depth x face velocity). The resulting AOI radiuses for each intake are 20.6 feet and 12.6 feet (see Figure 1).



**Figure 1. Area of Influence of Cooling Water Intakes at AEDC Primary Pumping Station**

## Threatened and Endangered Species

Recent aquatic surveys on and near Arnold Air Force Base in 1995, 2000, and 2010 did not report presence of any T&E species (CH2MHill 2000, CH2MHill 2001, USFWS 2010). However, historical surveys of the area did report finding specimens of species currently listed as endangered under the Endangered Species Act, as indicated by the TDEC Division of Natural Areas, Natural Heritage Database. These are Cumberland Pigtoe (*Pleuroaia gibberum*), Pale Lilliput (*Toxolasma cylindrellus*), and Slabside Pearlymussel (*Pleuroaia dolabelloides*).

The **Cumberland Pigtoe** was listed as endangered in 1991 and a fresh-dead specimen was found in Bradley Creek on Arnold AFB property in 1993 (Mullen et al. 1995). The specimen was cataloged at the University of Tennessee McClung Museum mollusk collection (Catalog Number 965). When subsequent surveys did not reveal additional specimens, a reassessment of the specimen identification concluded that the original identification as Cumberland Pigtoe was incorrect (Gerald Dinkins, University of Tennessee McClung Museum collection Curator, personal Communication with Peggy Shute, 2015 as per the 2015 5-year Review (U.S. Fish and Wildlife Service 2015). Therefore, the listing in the Natural Heritage Database is currently inaccurate and Cumberland Pigtoe presence is not a concern for this permit application.

The **Pale Lilliput** was listed as endangered in 1976 and surveys of the Elk River revealed specimens in 1954 and 1963 at Rutledge Ford (Herb Athearn, personal communication as per 1984 Recovery Plan (U.S. Fish and Wildlife Service 1984). During a 1980 TVA survey of the same location no Pale Lilliput specimens were located. Both the 1984 Recovery Plan and the 2001 5-Year Review state that the Pale Lilliput is believed to be extirpated from all historic locations (including the Elk River) except the Paint Rock River system in Jackson County, Alabama and Franklin County, Tennessee (U.S. Fish and Wildlife Service 1984, U.S. Fish and Wildlife Service 2001). Therefore, Pale Lilliput presence is not a concern for this permit application.

The **Slabside Pearlymussel** was listed as endangered in 2013 and surveys in 1980 by TVA of the Elk River revealed specimens at Rutledge Ford (10 river miles upstream from the cooling water intake) (TDEC 2015). Currently, there is no Recovery Plan for the species, but much information is provided in the Federal Register Listing (FR 2013a). The Elk River populations in Coffee and Franklin Counties upstream of Tim's Ford Dam (location of AAFB) are considered historical and not current, as more recent surveys show presence downstream of Tim's Ford Dam (36.7 river miles downstream of Elk River Dam (Woods Reservoir). Also, Critical Habitat on the Elk River (SP10) designated for the Slabside Pearlymussel in 2013 is downstream of Tim's Ford Dam (Wheeler Lake in Alabama to Ferris Creek influence in Tennessee) (FR 2013b). The USFWS does not believe that the Slabside Pearlymussel resides in Coffee or Franklin counties, TN (<http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spscode=F01Y>, visited 9/1/15).

While AAFB does support fish species known to host Slabside Pearlymussel glochidia (rosyface shiner, *Notropis rubellus*; silver shiner, *N. photogenis*; telescope shiner, *N. telescopus*; whitetail shiner, *Cyprinella galactura*; striped shiner, *Luxilus chrysocephalus*; warpaint shiner, *L. coccogenis*; and eastern blacknose dace, *Rhinichthys atratulus*), only the rosyface shiner may occur in streams near lakes (Neves 1991 in Parmalee and Bogan 1998, pp. 150– 152; Etnier and Starnes 1993, Mullen et al 1995, CH2MHill 2000, CH2MHill 2001, Jones and Neves 2002, pp. 18–20; AAFB 2011, Natureserve 2015). Therefore any effect of the CWIS to the suite of host species would be insignificant.

In addition, compared with the size of Woods reservoir the AOI is negligible. The area of Wood's Reservoir is 3,980 acres (173,368,800 ft<sup>2</sup>) while the area of the AOI ( $\frac{1}{2} \times \pi \times \text{radius}^2$ ) are 668 ft<sup>2</sup> and 251 ft<sup>2</sup> for a total of 918 ft<sup>2</sup>. The AOI represents only a fraction of the Woods Reservoir surface and is calculated as follows: % AOI =  $100 \times (918 / 173,368,800) = 0.00053 \%$ .

AAFB concludes, with the support of these data, concerns with threatened or endangered mussels and fish species utilized as hosts by mussel glochidia in the vicinity of the AEDC CWIS are unnecessary and a waiver of studies per 40 CFR 121.22 (r) and monitoring requirements in 40 CFR 125.96 should be considered for approval.

## **Literature Cited**

Ahlstedt, S.A. 1984. The molluscan fauna of the Elk River in Tennessee and Alabama. *American Malacological Bulletin*. 1984 (1): 43-50.

Arnold Air Force Base. 2011. Arnold Air Force Base Integrated Natural Resources Management Plan. 514 pp.

CH2MHill. 2001. Aquatic Resources Characterization: Final Report. Arnold Engineering Development Center. 106 pp.

CH2MHill. 2000. Rare, Threatened, and Endangered (RTE) Aquatic Invertebrate Survey: Final Report. Arnold Engineering Development Center. 80 pp.

Electric Power Research Institute. 2007. Cooling Water Intake Structure Area-of-Influence Evaluations for Ohio River Ecological Research Program Facilities. 178 pp.

Etnier, D.A. and W.C. Starnes. 1993. *The Fishes of Tennessee*. University of Tennessee Press, Knoxville. 689 pp.

Federal Register. 2013a. Volume 78, No.187/Thursday, September 26, 2013/Rules and Regulations. Pp. 59269 -5 9287.

Federal Register. 2013b. Volume 78, No.187/Thursday, September 26, 2013/Rules and Regulations. Pp. 59556 – 59620.

Hubbs, D.W. 2002. 2001-02 annual report: monitoring and management of endangered mussels. Unpublished report, Tennessee Wildlife Resources Agency, Project 7365, Nashville. 4 pp.

Jones, J.W., and R.J. Neves. 2002. Annual progress report for 2001: life history and artificial culture of endangered mussels. Report to the Tennessee Wildlife Resources Agency. Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, Virginia. 91 pp.

Mullen, D. B. Miller, B. Cushing, and J. Williams. 1995. An Investigation and assessment of rare, threatened, and endangered fauna and their habitats on Arnold Air Force Base, invertebrates, fish, amphibians, reptiles, mammals, and birds. Final Report to Arnold Engineering Development Center, U.S. Air Force. 106 pp.

Natureserve. 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, VA. U.S.A. Available <http://explorer.natureserve.org>. (Accessed: 9/4/15)

Neves, R.J. 1991. Mollusks. Pp. 251-320 in C. K. Terwilliger, editor. Virginia's endangered species. McDonald and Woodward Publishing Co., Blacksburg, Virginia.

Parmalee, P.W., and A.E. Bogan. 1998. The freshwater mussels of Tennessee. The University of Tennessee Press, Knoxville. 328 pp.

Tennessee Department of EC. 2015. Division of Natural Areas/Natural Heritage Database.

U.S. Fish and Wildlife Service. 1984. Pale Lilliput Pearly Mussel Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, GA. 46 pp.

U.S. Fish and Wildlife Service. 2010. 2010 Stream Assessment Report: Assessment of chemical, physical, and biological metrics for stream systems on Arnold AFB. USFWS Fisheries Resources, Niceville, FL. 33 pp.

U.S. Fish and Wildlife Service. 2011. Pale Lilliput (*Toxolasma cylindrellus*) 5-year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Southeast Region Alabama Ecological Services Field Office Daphne, Alabama. 27 pp.

U.S. Fish and Wildlife Service. 2015. Cumberland Pigtoe (*Pleurobema gibberum* = *Pleurobema gibberum*) 5-year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Southeast Region Tennessee Ecological Services Field Office Cookeville, Tennessee. 24 pp.